FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 85 Thursday, September 16, 1948 No. 1672

49, Wellington Street, London, W.C.2
'Grams: "Zacatecas, Rand, London"
'Phone: Temple Bar 3951 (Private Branch Exchange)
PUBLISHED WEEKLY: 26s. per annum (Home and Overseas)

Dangerous Competition

In conversation with the owner of a small brassfounding concern, we learnt that he was bitterly disappointed because a customer, who but a few months ago was beseeching him to accept orders, was now placing his orders elsewhere. Moreover, to this customer preferences and priorities had been extended, but now that the market situation is changing, all that the buyer was exhibiting was "base ingratitude." The brassfounder had our fullest sympathy. We refrained from entering into either ethics or economics. The latter demands the buying at the lowest figure consistent with quality, the former the preservation of goodwill and the realisation that courteous co-operation may, in the long run, outweigh the advantages of a temporary economy. In the smaller communities, firms know quite well why they have lost an order, and usually to whom. This disillusioned brassfounder, like hundreds of others, relies for his technical control on the use of ingots bought to guaranteed specification. His successful competitor, on the other hand, is making use of "gipsy-ed up" scrap, and therefore can have no real asurance that his "gunmetal" is really 88:10:2. Here then, is a problem meriting the serious consideration of non-ferrous foundries who are insufficiently large to operate their own laboratories for compositional control. All the good work done so successfully during the war to enable this class of small factory to supply the engineering industries with castings to specification is in danger of collapsing through economic pressure.

To retain the standard so recently attained, there is need for a campaign to be made to impress upon buyers of non-ferrous castings that there are several sorts of raw materials available for meeting their needs, but by resort to the cheapest, the overall technical control of these small factories may thereby be so disturbed that the general quality may be lowered—not only for their requirements, but for the whole of the clientele. This comes about through loss of knowledge by the founders as to the exact composition of their own scrap, in addition to that which they buy.

The managing director of a large non-ferrous foundry, just before the war, having, solely on price, lost an order for gunmetal castings from an equally large engineering firm, pointed out to the buyer that the amount he was paying would not cover the cost of the raw materials let alone that of manufacture. Later, he was in a position to examine a quantity of the scrap emanating from the very order in question. The castings were not gunmetal, the shortage of tin being very pronounced. The medium of approach to the problem is to consider service behaviour as the criterion. The specification for a given casting is laid down because a certain composition has been found to suit, and the buyer should hesitate in accepting a cheaper substitute before it has been well tried in his own machine shops and in its finished condition. Particularly in non-ferrous practice, only a small excess of impurity may completely upset casting properties, machinability, and service life alike. The use of poor quality material is to reduce a none-too-wide margin of safety. Unless buyers can be made to realise—and this quickly—that the price of non-ferrous castings can only be materially lowered by resort to the use of scrap of doubtful origin, there will be a large number of brassfounders bemoaning the "base ingratitude" of their boom-time customers.

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The 12th Aachen Foundry Colloquium

This function is to be held in the *Hüttenmännisches Institut* of the Aachen Technical High School on October 14 and 15.

The following papers are to be submitted:—

Thursday, October 14

Morning Session.—Modern Methods for the Melting and Refining of Light Alloys, by Dr. K. Schneider; the Mercury Extraction of Light Alloy Scrap, by Dr. W. Schmidt and Dr. Messner; the Refining of Light Alloys by the Halogens, by Dr. A. Schneider; and Modern Light Alloy Ingot and Billet Making, by Mr. W. Helling. (Chairman for the Light Metal Discussion, Professor M. Haas.)

Afternoon Session.—The Die-casting of Copper-base Alloys, by Dr. C. Adey; Gases in Non-ferrous (Copper-base) Metals, by Dr. Schwietzke; New Methods in Mass-production Foundry Handling, by Dr. K. Daeves; and Thoughts on Recruitment Problems in Foundries, by Dr. A. Gabriel. (Chairman, Dr. Schwietzke.)

Friday, October 15

Morning Session.—The Dynamic Properties of Cast Iron, by Professor J. N. Alcacer, of Madrid; the Mechanical Behaviour of Grey Irons and a Proposal for a new Normalisation Process, by Dr. A. Collaud, of Switzerland; Steps in the Study of Graphite Formation, by Mr. J. G. Pearce, M.Sc.; and Nodular Graphite in Cast Iron, by H. Morrogh. (Chairman, Professor E. Piwowarsky.)

Afternoon Session.—A Research on the Basic Principles of the Small Cupola, by Professor E. Piwowarsky and Dr. K. Krämer; the Hot Working of Cast Iron, by Professor E. Piwowarsky and Dr. A. Wittmoser; and the Question of Chrome Plating of Cylinder Linings and Piston Rings, by Dr. J. Denfeld. (Chairman, Mr. J. G. Pearce, M.Sc.)

Institution of Production Engineers

At Bournemouth, from September 23 to 25, will be held the first National Convention of the Institution of Production Engineers. The programme commences on September 23 with Dinner in the "Pavilion," after which Sir Bernard Paget will deliver a talk on Leadership. The next day, commencing at 10.30 a.m., the President, Dr. H. Schofield, C.B.E., will deliver his address, followed by the Education Report by the Chairman of the Education Committee; Lord Sempill on the "Hazleton Library"; and Sir Ernest Fisk on Britain's Industrial Problems. The afternoon will be devoted to Discussion Groups. In the evening will be the Civic Reception by the Mayor of Bournemouth. The programme will be concluded on September 25 with an address by Sir Ronald Weeks on Britain's Industrial Future.

Death of Mr. W. R. Blair

We regret to announce the death, at his home, Cambuslang, Glasgow, on September 10, 1948, of Mr. William Robert Blair, M.C., M.A., LL.B., Chairman of the British Ironfounders' Association, the British Bath Manufacturers' Association, Limited, and the National Light Castings Ironfounders' Federation.

Mr. Blair's long connection with the Light Castings Industry dates from his appointment in 1919, on demobilisation after the 1914-18 war, as Assistant Secretary to the National Light Castings Ironfounders' Federation; he succeeded to the full secretaryship in 1921, and assumed progressively increasing responsibilities in connection with all three organisations until, from 1930 onwards, he undertook the duties of Chairman. During the last war Mr. Blair served for a period with the Iron and Steel Control, and also with the coal industry.

In May, 1948, Mr. Blair suffered a severe heart attack and, whilst he was critically ill, he was making steady, if slow, progress towards recovery. Unfortunately, however, he suffered a relapse which proved fatal.

Latest Foundry Statistics

The Monthly Statistical Bulletin of the British Iron and Steel Federation shows that the steel produced in July for the making of steel castings averaged 6,200 tons weekly. This compares with 8,600 tons in June, 1948, and 6,100 in July, 1947.

The trend of employment in the iron foundries, which in May showed a slight loss of manpower, changed in June to a small gain of 27. The average number of people at work during the week ending June 5 was 145,776, of whom 136,394 were males.

British Standards Institution

The Monthly Information Sheet for July, 1948, lists amongst "New Standards Issued":—1121 Part 7, 1948: Methods for the analysis of steel. Tin in pig-iron, plain carbon steels and certain low-alloy steels. (1s.); 1121 Part 9, 1948: Methods for the analysis of steel. Phosphorus in high chromium-nickel steels. (1s.); 1121 Part 10, 1948: Methods for the analysis of steel. Silicon in all types of irons and plain and alloy steels. (1s.); 1456, 1948: 1¼ per cent. manganese steel castings. (2s.); 1457, 1948: Austenitic manganese steel castings. (2s.); and 1458/9, 1948: Alloy steel castings for structural and general engineering purposes. (2s.)

Amongst "Revised Standards Issued" there is 44, 1948: Cast-iron pipes for hydraulic power. (3s.); whilst in "Future Publications" is listed 1121, Part 11, 1948: Methods for the analysis of steel. Carbon in steel and low-carbon ferro-chromium. (1s.), but we understand this has since been made available.

Change of Address:

The official address of the Institute of Australian Foundrymen is now Melbourne Technical College, Latrobe Street, Melbourne, C.1.

Official Exchange Paper of the American Foundrymen's Association.

Do You Use Your Cost System?*

Costing as an Aid to Management

By Ralph L. Lee†

ABSTRACT

The Author stresses the importance of having in operation a good costing system in order to know costs of production and operation. If too little be charged for castings the foundry so doing will eventually go out of business. If too much be charged, the customer may go out of business. Appended to the Paper are wages office, production-order and standard-cost procedures as followed by a large grey-iron foundry.

Introduction

Almost all of the foundry trade associations in the United Kingdom and the United States have published or have available good cost systems. For the average foundry, it is more a matter of deciding how simple or how complex the cost system is to be and then putting it into operation. The problem in many foundries is that a great deal of time and money is spent in obtaining the correct results of past operations and then these "costs" go into a binder or folder and are "kept" under cover. The writer has been in a number of foundries where the costs are carefully completed and ledgers balanced in from two to four months after the finished castings have been shipped and then the cost reports are filed. This method of "keeping costs" may give employment in and be a pleasure to the cost department, and the pay roll and other costs may be distributed to the penny, but it does not help in intelligent and profitable operation of the foundry. No cost system is of real value unless it can be, and is, used to judge current operations and accurately to forecast results. How can this be done? The system may be used for both current and future operations.

Current Operations

Costs should be completed quickly and compared with the estimating sheets to make sure that the estimate is correct. Prices on new orders should be checked and if the cost experience is fairly recent this cost may be used as a guide. If the estimate be correct, then the labour and other costs become "standard," and only those costs which are under or over standard are reported.

Most of the overhead items are costed as a percentage of direct labour in the departments. Usually in the preparation of this overhead percentage, excess direct labour costs are included in the direct labour money total on which the overhead percentage for indirect costs are established. Unless the excess labour cost can be eliminated, then it must become a part of the standard cost used on the estimate sheet for the particular job, or that part of the overhead will be lost.

For intelligent operating management, these excess costs must be brought to the attention of the supervisors promptly. What good does it do to tell a superintendent in March that a job cost too much in January? He should know within a day or two in order to make corrections while the job is running. A daily report of excess charges may be made as shown in Fig. 1.

Departmental and plant supervisory meetings should be held to discuss these excess charges and proper

*Presented at the London Conference of the Institute of British Foundrymen, June, 1948.

† Secretary-Treasurer, Grede Foundries, Inc., Milwaukee, Wisc. U.S.A., also Chairman, A.F.A. Foundry Cost Committee.

DAILY LABOUR LOSS REPORT.

ORIGINAL—To Foundry Supt. Week No.....Period No.....
DUPLICATE—To Foundry Office File. .....DEPARTMENT.
TRIPLICATE—To General Acctg. Dept. Date.....19....

Pattern No.	Reason for labour loss and remarks.	Oper. No.	Total.	Chargeable to						
				Metal.	Moulding.	Sandslinger.	Core.		Cleaning.	Maintenance.
Total to-day ..										
Total period to date ..										

FIG. 1.—DAILY REPORT FORM FOR EXCESS CHARGES.

Foundry Cost System

action should be taken. As stated above, if the excess cannot be eliminated, then it must become a part of the standard and included in the cost on the estimate sheet. These daily reports should then be combined in a weekly report shown in Fig. 2.

Future Operations

With the historical record of past costs on a particular casting and the percentage increases or decreases in labour, metals, etc., it is an easy matter to forecast future results based on past experience. These results are checked currently by the method shown under "Current Operations." The estimate sheet is revised by using the current change percentages and then the new estimate becomes the "standard cost."

Over-all average percentages* should not be used. The Author has seen cases where a foundry has used averages and compared, say, January, 1947, with January, 1948, where increases have been as follows:—

	Average percentage of total.	Percentage increase Jan., 1948, over Jan., 1947.	Present cost. Dollars	Average increase, per cent.
Metals	14	50	21.00	
Direct labour ..	21	12	23.52	
All other costs ..	65	17	76.05	
	100		120.57	20.57

* It must be emphasised that the percentages shown are for illustration and are not actual.

Using average figures, this percentage of 20.57 would be used on all castings. It would be quite difficult to assess these percentages on each individual casting, but the work in the average foundry can be divided into a number of classifications, the number depending on the complexity of the work. How do the figures on certain classes of castings compare with the average?

The following is a comparison of a flywheel and a cylinder block for a Diesel engine:—

Diesel Flywheel Casting.

	Per cent. of total cost.	Per cent. increase.	Present cost. Dollars
Metals	50	50	75.00
Direct labour ..	12	12	13.44
All other costs ..	38	17	44.46
	100		132.90

Per cent. increase, January, 1948, over January, 1947, is 32.90

Diesel Cylinder Block.

	Per cent. of total cost.	Per cent. increase.	Present cost. Dollars
Metals	19	50	28.50
Direct labour ..	19	12	21.28
All other costs ..	62	17	72.54
	100		122.32

Per cent. increase, January, 1948, over January, 1947, is 22.32

The percentage difference on the flywheel is 12.33 (32.90 per cent. minus 20.57 per cent.), which on

SUMMARY OF LABOUR LOSSES AND COST OF COMPLETED CASTING SALES.

No. .....

ORIGINAL—To Foundry Supt.
DUPLICATE—To Foundry Office File.
TRIPLICATE—To General Acctg. Dept.

Week No..... Period No.....

Date .....19....

Pattern No.	Pieces despatched.	Labour losses on excess production. Mould. Pieces prod.	Mould. Labour loss.	Chip. Pieces prod.	Chip. Labour loss.	Test. Pieces prod.	Test. Labour loss.	Total (labour loss).	Labour loss on defective castings.	Total labour loss.	Total labour cost exclusive of labour losses.
		Between "Mould" and "Chip" there are columns of a similar character for "Sandslinger"; "Core"; "Shake-out"; "Mill"; "Sand Blast"; "Scale"; and "Grind"; and two additional columns without captions.									
Total this week											
Total period to date											
Burden period to date											

FIG. 2.—WEEKLY SUMMARY FORM.

$1,000,000 production would be $123,300 and would probably be more than the whole of the company's anticipated profit.

If the average figures be used, under competitive conditions, a foundry using these and quoting against those using cost figures intelligently, would tend to fill up with work similar to the flywheel and would lose about 12½ per cent. on each job. This figure might well be 20 per cent. and higher on some jobs.

There are many other ways in which a cost system can be used profitably. Competition will be getting keener, the days of the seller's market are on the way out. The Author has chiefly referred to excess costs but it must not be forgotten that where costs are lower than average, the customer should get the benefit. If too little be charged for castings, the foundry will eventually go out of business. If too much be charged the customer may go out of business; hence "know your costs."

The system for wages, production-order, and standard cost procedures are applied in an existing foundry as follows:—

WAGES PROCEDURE—CLEANING DEPARTMENT

Former Procedure.—Under the procedure formerly in effect in the cleaning department, each employee kept a record of his individual production on an operation ticket, recording thereon the pattern number, operation, and number of pieces with respect to each pattern worked on during the day. At the end of the day the data shown on the operation ticket were copied on a second operation ticket, so that two identical records of production for each employee would be available. One copy would be retained by the individual employee to furnish him with a record of the work performed during the day, and to serve as a medium on which he could compute his earnings, and the other turned over to the wages office for wages calculations.

In the wages office, the information shown on each operation ticket for each employee was completely transcribed daily on to a summary of operations, which set forth a record of the work performed by each employee and the related earnings classified as to direct and indirect wages, based on piece-work, and the hours of day-work. The daily piece-work earnings and hours of day-work for each employee were posted daily on a card, from the summary above referred to, and the earnings for the payroll week were totalled and recorded thereon after the summary card had been matched with the related attendance clock card. The wages amount was assessed on the basis of the information appearing on the summary card.

The foregoing method of compiling the wages data involved a certain amount of duplication of clerical effort, and, in addition, did not provide the basis for the accumulation of cost data with reference to each lot of castings produced.

The revised procedure provides that each employee makes out a separate production ticket covering the production with respect to each pattern worked on during the day. The production ticket is designed to facilitate the preparation of the wages and readily provide a means of tabulation of labour statistics with reference to each pattern produced, including a comparison of the quantity of each casting reported as having been produced at each operation with the actual quantity despatched. One type of production ticket is provided, in addition to a day-work ticket, both of which are shown in Figs. 3 and 4.

Regular Form of Production Ticket

The ticket (Fig. 3) which will be used for the most part to report cleaning department direct labour opera-

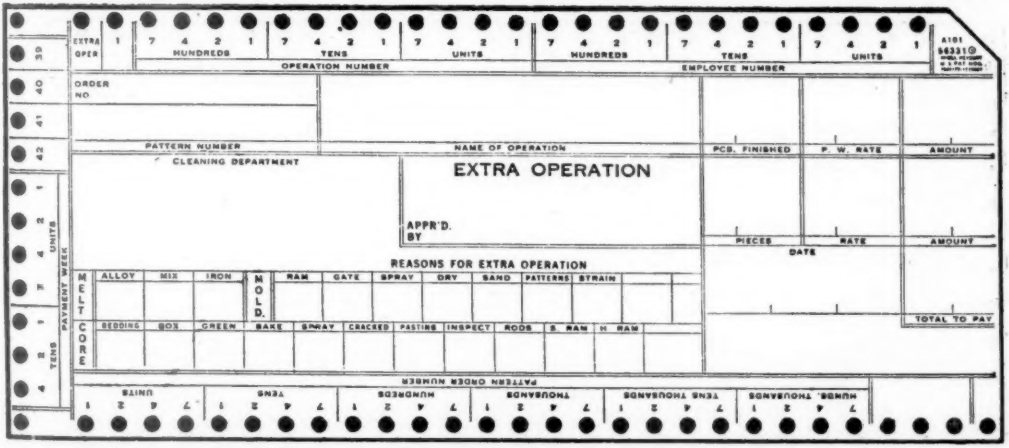

FIG. 3.—CLEANING DEPARTMENT DIRECT-LABOUR PRODUCTION TICKET.

Foundry Cost System

tions is designed to provide space on the outer edges of the ticket to record the numerical code designation for the following:—Employee number; labour operation number; pattern order number; wages period—year and week; and extra operation.

In the body of the card space is provided for the following data which will be recorded thereon by the employees indicated:—

Cleaning department employee: Pattern number; name of operation; pieces finished; pieces finished on extra operation; and date.

Cleaning department foreman (in ink or indelible pencil): Pieces on which extra operation will be required; reason for extra operation; piece-work rate for extra operation; and approval.

Wages office: Pattern order number; piece-work rate and amount; amount of extra operation; and total to pay.

The tickets will also bear the name and clock number of the employee, which will be imprinted on the cards with an Addressograph.

It is understood that employees in the cleaning department work for the most part on one operation. Consequently it is intended that each employee be furnished with a number of tickets on which his employee number and operation number have been slotted in advance. To take care of the limited number of cases in the cleaning department where one employee performs several operations on the same casting, operation numbers will be assigned to cover each group of operations, which might ordinarily be completed by one individual so that production can be reported by the employee under the appropriate operation number.

In the cleaning department it frequently happens that extra piece-work allowances are made by the cleaning department foreman because of extra work on castings entailed by reason of faulty work in a preceding department. Space has been provided on the production ticket to record extra operations of this character, together with the related rate and wages figure. The reasons for the extra work, together with space to indicate the number of castings under each reason, are also shown on the ticket, as follows:—

Melting—Alloy; mix; and iron.

Moulding—Ram; gate; spray; dry; sand; pattern; and strain.

Core—Bedding; box; green; bake; spray; cracked; pasting; inspection; rods; soft ram; and hard ram.

The rates applicable to the extra operations will be noted on the tickets by the foreman, who will also indicate the cause of defectiveness necessitating the extra operation and will approve of the tickets.

In this connection, it is recommended that production tickets covering castings on which there will be an extra operation be written up in advance by the foreman to show the number of castings involved and the reasons for the extra operation. In the event that the employee fails to complete the entire batch during the day, the foreman will change the quantity shown on the ticket by marking out the original quantity and inserting above the quantity actually finished. He will then prepare an additional ticket for the castings not completed and note thereon the cause of defectiveness of those castings.

Employees in the cleaning department will continue to record their production by pattern numbers on the green production ticket now in use in the department for that purpose, which they will retain as a record of their production for the day. *In lieu* of re-copying

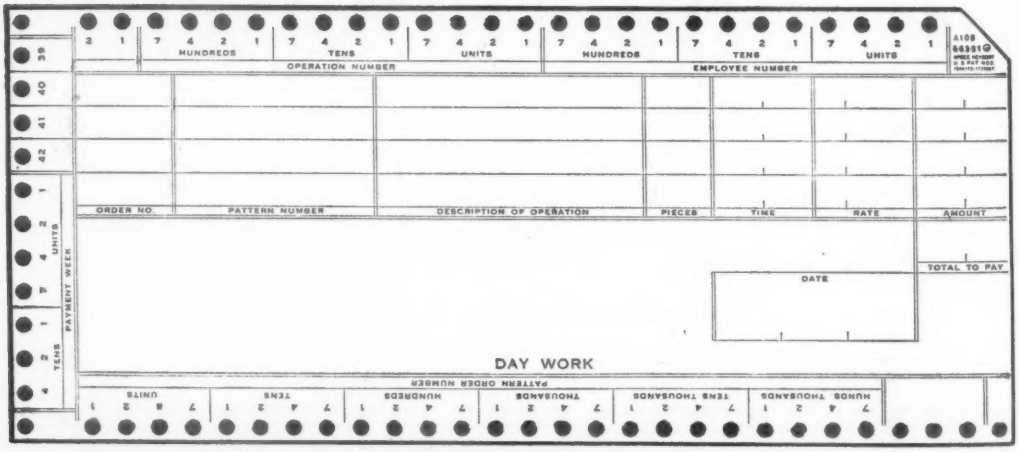

FIG. 4.—NORMAL DAY-WORK TICKET FOR INDIRECT LABOUR.

the information on to a second production ticket, however, they will make out a production ticket for each pattern, showing operation, number of pieces, pattern number and date, for use of the office in computing the wages and compiling statistics relating to production.

The classification of time and earnings will be made in the wages office, but the clerk in the cleaning department will, at the end of the day, record the total number of tickets for each employee, including day-work tickets, if any, on the reverse side of one of the production tickets. This will furnish the wages office with a means of determining that all of the tickets for each employee for the day are accounted for. In addition the clerk will record on the same ticket, the total hours worked by the employee for the day, which information will be obtained from the attendance clock card.

Regular piece-work tickets which are not pre-slotted with the operation number will be made available to each employee. These tickets will be used in instances where the employee is engaged on a piece-work operation to which he is ordinarily not assigned, in which case it will not be possible to pre-slot the card for the operation number; the operation number will be slotted after the card has been handed in to the wages office. In addition to the regular production ticket described above, a special production ticket will be used in the cleaning department as follows:

Special-production Ticket for Reporting Repeat Operations

The special-production ticket is identical in form with the regular production ticket, excepting that no provision is made thereon to record extra operations as no extra operations should be involved in connection with the work to be reported on this ticket. The special-operation ticket is to be used to record repeat operations, necessitated by reason of faulty workmanship. Repeat operations will usually be required by reason of welds or re-welds. The ticket will be pre-slotted for employee and operation number.

When a casting has been rejected by an inspector and one or more operations must be repeated thereon, because of welds or re-welds, or for other reasons, the work must be reported on the special ticket provided for the purpose. It will not be necessary to tag the casting or otherwise mark it to indicate to the employee that a repeat operation is involved, as the position of the casting in the production line will constitute notice to that effect.

All special tickets reporting repeat operations should be reviewed by the foreman before being forwarded to the wages office. The tickets should be noted by him as to the department responsible for the special work, and the reasons therefor, so that proper accounting distribution may be made of the related pay-sheet charges, in the wages office.

Tickets containing a record of extra operations and repeat operations should be summarised daily in the wages office, and a daily report of the related excessive labour costs should be furnished to the foundry. This report will contain a record of the excessive labour costs at each operation with respect to each pattern number as well as the total amount for the day. In addition, these excessive labour costs will be set out separately in the general accounts, classified as to the departments responsible.

It is also provided that the labour loss on each pattern by operations, representing the difference between the quantity of castings reported as produced at each operation and the quantity despatched (after allowance for normal scrap), be determined when the job is finished and summarised on a weekly report (Fig. 2). In this manner, any failure on the part of the

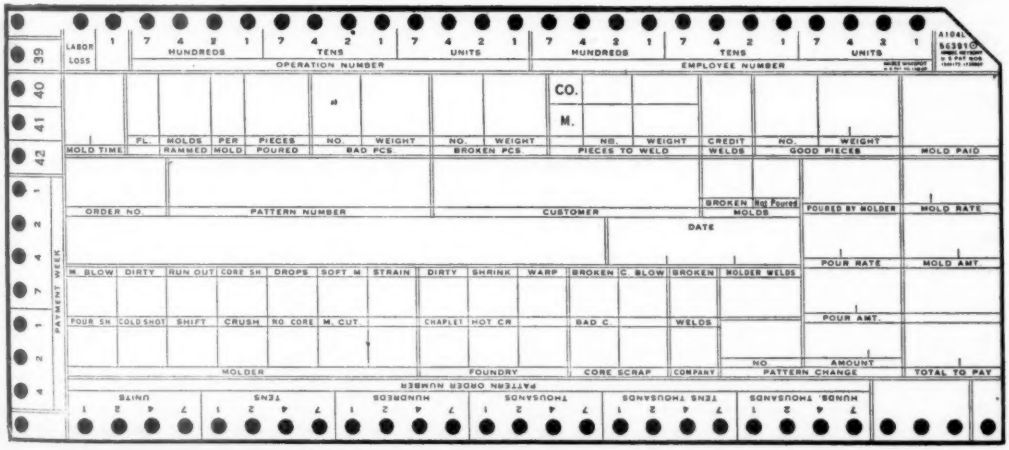

FIG. 5.—MOULDING DEPARTMENT PRODUCTION TICKET FOR RECORDING DIRECT LABOUR.

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foundry to report defective work as such, will subsequently be disclosed.

Day-work Ticket

The day-work ticket (Fig. 4) is to be used to report all indirect labour, whether paid for on a day-work or a piece-work basis. These tickets will be pre-slotted for the employee number only. Each employee in the cleaning department will be furnished with a supply of the three types of tickets described above. Each type of ticket will carry a different coloured border to distinguish it readily from the others. They will all be "Addressograph-ed" in advance with the employee's name and clock number, and will be pre-slotted with the employee's clock number. In addition, the regular ticket and the special ticket for reporting repeat operations will be pre-slotted with the operation number.

WAGES PROCEDURE—MOULDING DEPARTMENT

The revised wages procedure requires that the mould checker prepare a separate production ticket covering the production of each employee on each separate pattern worked on during the day. The production ticket is designed to facilitate the preparation of the wage ticket and the tabulation of labour statistics with reference to castings produced compared with the quantity shipped.

Two separate forms of tickets will be used to report labour operations in the moulding department—first, a production ticket for reporting all direct labour operations, and second, a day-work ticket for reporting all indirect labour operations, whether paid for on a day-work or piece-work basis.

Production Ticket

A sample of the production ticket to be used in the mould department for reporting direct labour operations is shown in Fig. 5. The production ticket consists of two parts; (*a*) original, on paper stock, which will be used as a scrap report in the manner hereinafter described, and (*b*) duplicate, on card stock, which will constitute the record of production on which the earnings of the employee will be computed. Space is provided on the outer edge of the ticket to record the ployee number; labour operation number; pattern order number; wages period—year and week, and numerical code designation for the following:—Em-labour loss.

The employee number and labour operation number will be slotted on the tickets, and the name and clock number of the employee Addressograph-ed thereon, in the space provided, before the tickets are distributed for use. The pattern order number, wages period, and labour loss will be slotted on the tickets after they have been handed in to the wages office.

The reason for providing for a labour-loss code designation on the border of the card is to permit ready accumulation in the wages office of the labour cost of broken moulds, Company-broken castings, and Company welds. The recommended procedure provides that tickets containing a record of the above operations be summarised daily in the wages office, and a daily report of the related labour costs be furnished to the foundry, segregated as to pattern number. In addition, the amount of these labour losses will be set out separateiy in the general accounts. Excessive labour costs must be properly segregated and classified in order for them to be adequately controlled.

The various moulders will not record their own production; this will be done by the mould checker in conformity with the practice previously followed. The mould checker will prepare a separate ticket covering the production on each pattern by each employee during the day. In the body of the card, space is pro-

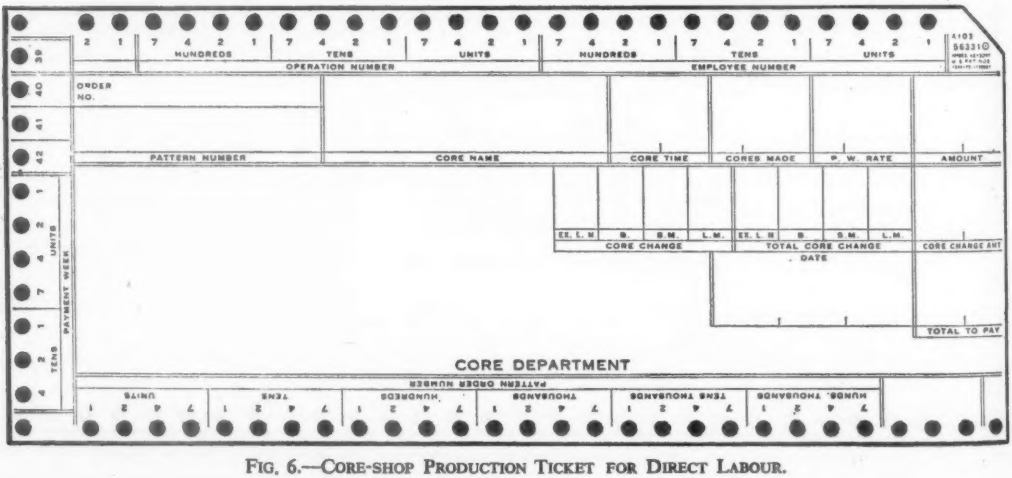

FIG. 6.—CORE-SHOP PRODUCTION TICKET FOR DIRECT LABOUR.

vided for the following data which will be recorded thereon by the employees indicated:—

Mould checker, on original and duplicate tickets: Pattern number; mould time; floor; moulds rammed; pieces per mould; moulds broken; moulds not poured; moulds poured by moulder, and date.

Wages office, on duplicate ticket: Pattern order number; pieces poured; bad pieces; broken pieces; pieces to weld; credit welds; good pieces; moulds paid; weight each; shake-out labour rate and amount; mould and pour rates; mould and pour amounts; pattern change amount; total to pay, and reasons for defective castings.

Inspector, on original ticket: Reasons for defective castings.

The mould checker previously recorded the above information on a piece of scratch paper from which it was later transferred to a form designated as a mould checker's record. The information shown on the mould checker's record as to the production of the various moulders for the day was subsequently transferred to a daily summary on which the earnings of the various employees in the moulding department were later computed. The computation of earnings for each employee was made when the scrap report relating to the day's production was handed in by the inspector, which permitted the determination of the number of pieces on which the employee was entitled to receive remuneration.

The information to be noted on the production ticket by the mould checker, as outlined above, will be written on the original copy of the ticket, but it will also appear on the duplicate by reason of the duplicating-carbon areas affixed to the reverse side of the original.

Recording of Group Operations

The number of pattern changes made by each moulder during the day will be collected and recorded by the mould checker on the ticket covering the last production for each moulder for the day. Sandslinger moulding is a group operation. The mould checker will prepare a production ticket covering the production on each pattern by the Sandslinger moulder crew. In addition one ticket for the day will be prepared for each man participating in the Sandslinger mould production, on which it will be indicated that the employee is a member of the group, and the total number of hours he has worked in that capacity. The distribution of the group earnings will be made in the wages office.

With respect to shake-out, which is also a group operation, a daily ticket will be prepared for each member of the shake-out crew, showing total hours worked in that capacity. The labour cost of the shake-outs relating to each pattern will be computed on each production ticket in the wages office, based on the shake-out rate applicable to each pattern, and the total shake-out labour for the day determined, which will be divided between the individual crew members according to hours worked.

After the production tickets have been completed by the mould checker in the manner indicated above, he will detach the original from each ticket and pass it along to the inspector, the latter will use it to record the scrap relating to the particular production. The duplicate of the production tickets will be given to the wages office.

The inspector will record on each ticket the quantity of scrap relating to the particular production, classified acording to the reasons, and indicating the responsibility, as set out on the ticket. Such classification of scrap involves no changes in the procedure formerly followed. He will then forward these scrap reports to the wages office, where they will be matched with the related duplicate tickets, and the information will be transferred to the latter record. The duplicate ticket

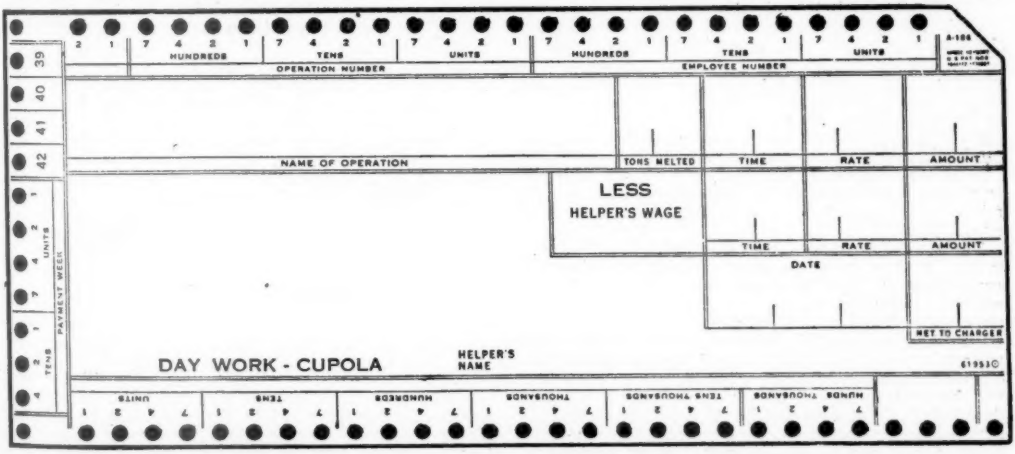

FIG. 7.—SPECIAL DAY-WORK TICKET FOR REPORTING CUPOLA PRODUCTION.

Foundry Cost System

will then contain a complete record of the production for which the employee will receive payment, as well as a record of the scrap produced.

When the information shown on the scrap reports has been transferred to the duplicate tickets covering the production for the day, the scrap reports will be returned to the foundry where they will be turned over to the respective employees to furnish them with a record of their production.

The mould checker will, at the end of the day, record the total number of tickets for each employee, including day-work tickets, if any, on the reverse side of one of the production tickets. This will furnish the wages office with a means of checking that all the tickets for each employee for the day are accounted for. In addition, he will record on the same ticket the total hours worked by the employee, which information will be obtained from the attendance clock card.

Day-work Ticket

The day-work ticket is to be used to report all indirect labour, whether paid for on a day-work basis or a piece-work basis. Individual day-work tickets should be prepared for each member of the mould-pouring crew. The day-work tickets will be pre-slotted for the employee number only.

The mould checker will be furnished with a supply of the production and day-work tickets for each employee. The two types of tickets will carry different coloured borders to distinguish them from one another. They will be Addressograph-ed in advance with the employee's name and clock number, and will be pre-slotted with the employee's clock number. In addition, the production ticket will be pre-slotted with the operation number.

WAGES PROCEDURE—CORE SHOP

Under the procedure formerly in operation in the cleaning department, each core checker kept a record of daily production of cores for employees by pattern number. These reports were sent to the wages office each day, where they were posted to a daily summary of cores produced by pattern number for each core maker. At the end of the weekly pay period, the total production for each pattern was ascertained and extended at the established piece-work rates, and the total piece-work earnings for the employee were determined and recorded on his weekly summary of production.

The revised procedure provides that the core checker make out a separate production ticket covering the production of each employee with respect to each pattern worked on during the day. The production ticket is designed to facilitate the preparation of the wages sheet and the tabulation of labour statistics with reference to each casting produced, compared with the quantity despatched. Two separate forms of tickets will be used to report labour operations in the core department—first, a production ticket for reporting all direct labour operations, and, second, a day-work ticket for reporting all indirect labour operations, whether paid for on a day-work or a piece-work basis.

Core-shop Production Ticket

A sample of the production ticket to be used in the core shop for reporting direct-labour operations is shown in Fig. 6. It will be noted the ticket is designed to provide space on the outer edges thereof for the numerical code designation for the following:—Employee number; labour operation number; pattern order number; and wages period—year and week.

The employee number and labour operation number will be slotted on the tickets, and the name and clock number of the employee Addressograph-ed thereon, in the space provided, before the tickets are distributed for use. The pattern order number and wages period will be slotted on the tickets after they have been handed in to the wages office.

Each core-maker will prepare a separate ticket covering his production with respect to each pattern number, recording on the ticket the following information:—Pattern number; core name; core time; cores made; and date.

In addition he will record the core change, if any, classified as to type, in the space provided on the ticket. The number of core changes made by a core-maker during the day will be assembled in the wages office from the information shown on the individual tickets, and will be recorded on one ticket for the purpose of computing the earnings applicable thereto.

The clerk in the core department will, at the end of the day, record the total number of tickets for each employee, including day-work tickets, if any, on one of the production tickets. This will furnish the wages office with a means of checking that all of the tickets for each employee for the day are accounted for. In addition he will record on the same ticket, in the space provided on the reverse side of the ticket, the total hours worked by the employee, which information will be obtained from the attendance clock card.

Day-work Ticket

The day-work ticket is to be used to report all indirect labour, whether paid for on a day-work or a piece-work basis. These tickets will be pre-slotted for the employee number only. Each employee in the core shop will be furnished with a supply of the production and day-work tickets. Each type of ticket will carry a differently coloured border to distinguish it readily from the other. They will both be Addressograph-ed in advance with the employee's name and clock number, and will be pre-slotted with the employee's clock number. In addition, the production ticket will be pre-slotted with the operation number.

(To be continued.)

Scientific Film Festival

Concurrently with the International Scientific Film Congress, announced in the JOURNAL, July 1, will be held in London on October 8, 9, and 10, the International Scientific Film Festival. There will be two sessions daily from 2.30 to 5.30 p.m. and from 7.30 p.m. to 10.30 p.m., at which the public will be able to see and discuss scientific films from many countries. Further details may be obtained from the Scientific Film Association, 34, Soho Square, London, W.1.

The Solidification of Metals*

Fundamental Difficulties associated with Founding

By Dr. E. Scheuer, of International Alloys, Limited

(*Continued from p.* 248)

The Ideal Shrinkage Cavity and Interfering Factors

The question of where the shrinkage cavities form and how they are shaped can be answered in simple terms so long as it is assumed that the metal freezes in shells along the mould walls.[6] Each body of freezing metal will form a pipe or pipes at the open top—that is, the spot where cooling from the outside is least. These pipes represent the contraction during solidification of all liquid metal which has direct connection with the top. As soon as liquid parts are cut off from each other by the joining of the shells growing from the mould walls, each liquid body in its closed cell will develop a pipe at its highest point as the liquid metal level in the cell sinks following the contraction.

One can thus map out the shrinkage in a casting by putting on to the mould wall solid layers of uniform thickness one on top of the other and cutting it off at the top end at the level to which the liquid would have fallen as a result of the contraction in freezing the layer (Fig. 8).

However, owing to differences in the rate of cooling, the thickness of the layers deposited during the same period in different parts of the casting will, in general, not be uniform. Exposed corners of the casting will be cooled more rapidly and recesses more slowly than flat surfaces. The dry-sand cores will have a much smaller cooling effect than the green outer parts of the mould, and these very much less than an outer mould made from metal. Some parts of the mould near the gates will be heated in filling as a large quantity of metal flows through them, others will just receive the relatively cool metal when it comes to rest. Obviously in the first-named points, hot metal freezes slowly between hot mould-walls, and in the second case cool metal freezes more rapidly between cold mould walls.

The speed of filling the mould has also an effect as the bottom parts might be exposed to the cooling by the mould some time before the top parts are filled, and so to speak are one or two layers ahead in freezing compared with the top parts. Provided one could measure all these effects precisely, one would be able to predict the exact size, shape, and the position of all shrinkage cavities in the casting.

Complications Caused by Grain Size and Arrangement

There are, however, other complications which result from the shape and arrangement of grains in the metal during freezing. For the purposes of this paper the great variety of possible conditions can be reduced to mixtures of three typical cases (Fig. 9). (1) Shell type—all crystals rigidly joined, forming a continuous and solid shell; (2) skeleton type—all crystals rigidly joined together in contact points, liquid moving in the interstices; and (3) friable type—all crystals unconnected embedded in liquid. In practice one rarely finds these types alone. Mostly two or even three of them exist side by side if a section be taken from the liquid centre of the casting through the freezing layer towards the mould wall, but one of them will be predominant. Which type is found predominant in any casting depends on the speed of cooling as well as on the alloy.

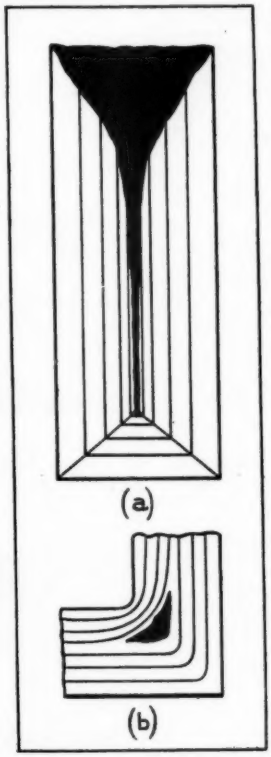

FIG. 8.—DIAGRAM OF OPEN (*a*) AND CLOSED (*b*) SHRINKAGE CAVITIES (PIPING).
After G. Sachs, Prakt. Metallkunde.

Open Pipes on Air-cooled Surfaces

The shape of the open pipe in a riser, for instance, or in an open chill ingot (Fig. 10) is a depression with smooth walls with the shell type, a depression with a skeleton of crystals in it with the skeleton type, and a depression with a porous area of metal at its bottom in the friable type.

Open Pipes and Mould-cooled Surfaces

Other outside defects form on the walls of the casting. Suppose a volume of liquid metal has been isolated by solid metal during the freezing of the casting so that a shrinkage cavity should form in the interior. This cavity would obviously be a vacuum; the question is now, if the shell can stand the atmospheric pressure from outside.

A continuously solid shell as in case (1) will either resist or bend. In the latter case there is a

* A paper presented to the Slough Section of the London Branch of the Institute of British Foundrymen.

The Solidification of Metals

shallow smooth depression. In the skeleton type of shell, the skeleton will mostly stand up, but the liquid will be sucked in between the

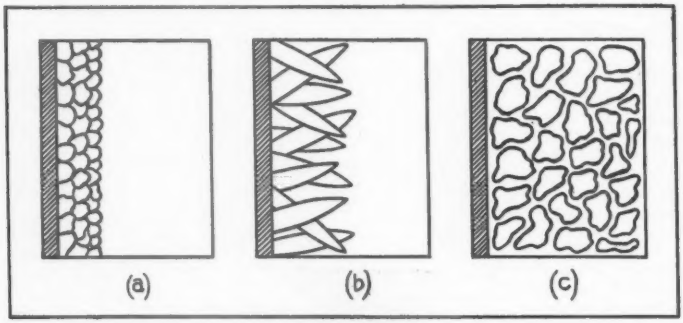

FIG. 9.—DIAGRAM OF THE THREE BASIC TYPES OF SOLIDIFICATION.
(*a*) Shell type: all crystals rigidly joined, forming a continuous solid shell. (*b*) Skeleton type: all crystals rigidly joined in contact points, liquid moving in interstices. (*c*) Friable type: all crystals unconnected, embedded in liquid.

crystals and the result will be a spongy patch on the surface with or without a shallow depression. In a friable shell there is most likely a depression as the mechanical strength of the shell is very low. Owing to the lack of connection between the crystals, however, the shell will tend to break rather than to bend. The liquid will also tend to be sucked back into the centre, leaving narrow channels and fissures (Fig. 11).

One thing should be remembered when considering shrinkage along the mould wall. As soon as a part of the metal surface has started to shrink away from the mould wall it is bound to become increasingly exposed to further shrinkage in this place, because, by losing contact with the cooling mould wall it remains further behind in freezing and will tend to remain soft or liquid and to feed adjacent parts which freeze earlier.

Intercrystalline Shrinkage Cavities

In the freezing, according to the skeleton or the friable type, the common development is that the movement of liquid is more and more restricted, as the interstices between the dendrites and dendrite branches become narrower. In the end, small portions of the liquid are completely enclosed by solid metal. Shrinkage cavities under these conditions become more and more ramified and eventually assume the form of small angular holes, clefts and crevices between the dendrites and branches of dendrites.

If gases be liberated during freezing, they will also be trapped in this system of channels and crevices filling the shrinkage cavities and creating air locks which make feeding more difficult even before the channels are blocked by solid metal. All these complications are, to a certain degree, the rule rather than the exception, and it is because of these deficiencies in coherence that the strength of castings in certain metals is much lower than that of forged articles of similar composition.

In the interior shrinkage the various types of crystallisation have very much the same effect as in open pipes. The shell type is the simplest one, and therefore served as a model for the purpose of describing the general shape and position of shrinkage cavities. In this case, the cavities

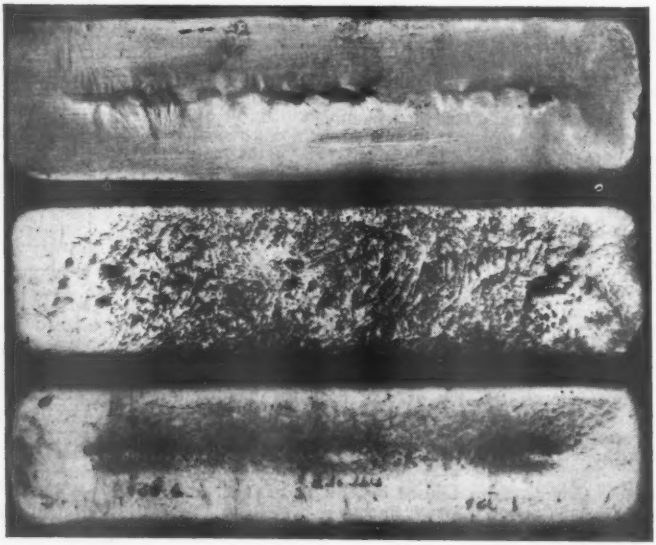

FIG. 10.—EXAMPLES OF OPEN SHRINKAGE OF THE THREE BASIC TYPES OF SOLIDIFICATION.
(*a*) Shell type: single cavity with smooth walls. (*b*) Skeleton type: cavity filled by skeleton of crystals. (*c*) Friable type: cavity ramified, forming porous metal.

are single holes for each isolated body of liquid and have smooth walls. The skeleton type will have a generally similar over-all shape of cavity, but a lattice of crystals will be found in the cavities. The shrinkage cavity, strictly speaking, might be the same as, or more often smaller than, with shell-type solidification, but the spongy distribution of the cavity causes a larger part of the casting to be affected.

In the friable type of solidification the distribution and ramification of the shrinkage is obviously still more pronounced. With a rather coarse type of skeleton, one expects a network of channels somewhat similar to a sponge. With the friable type, shrinkage is more like the cavities in a heap of gravel or sand (Fig. 12). The crystals will be joined only at points and angular wedge-shape fissures and clefts will be surrounding them.

These cavities are often so narrow that they can hardly be detected even on machined sections. In spite of being generally of lower total volume than the coarser type they are spread over a considerable area and can easily form leakages through an apparently quite faultless cast wall (Fig. 13).

Methods of Reducing the Danger of Shrinkage Cavities

How may the danger of large and small shrinkage cavities be avoided or reduced?

Large Shrinkage Cavities

As to the large ones the case is relatively simple. The places where the metal freezes last in any closed "cell" are the ones which have got to be "fed." If feeding be not possible in any such place, the remedy consists in so guiding the heat flow as to make this place freeze earlier. Well known means of controlling the temperature distribution in castings are the positioning of runners and risers the building-in of metal chills into sand moulds, the heating or cooling of certain parts of permanent moulds either before assembly or after assembling the mould, and finally the skilful use of insulating diecoat in various thicknesses.

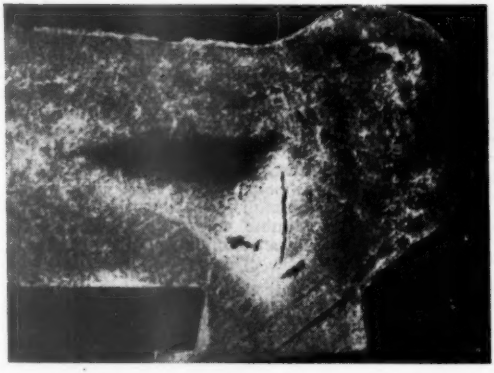

FIG. 11.—SECONDARY OUTSIDE SHRINKAGE OF FRIABLE TYPE SOLIDIFICATION.
Friable crust over internal shrinkage depressed by atmospheric pressure and cracked.

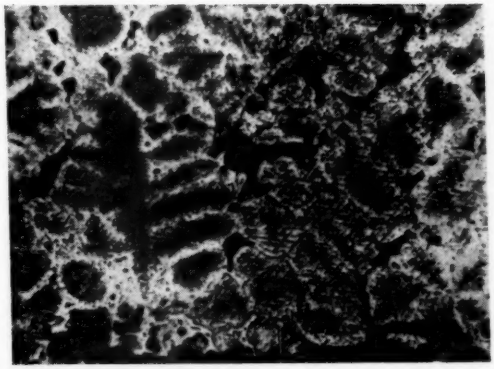

FIG. 12.—ANGULAR INTERCRYSTALLINE SHRINKAGE CAVITIES IN FRIABLE TYPE SOLIDIFICATION (ADMIRALTY BRONZE).

Recently two new means of keeping open risers at inaccessible places have been recommended. One is a highly insulating insert placed against the spot where the piping is to be initiated,[7] the second is a core-like insert which, when heated by the inflowing metal will heat itself by a chemical reaction of its components for a predetermined time and temperature.[8]

Diffuse Shrinkage Cavities.

In order to reduce the finely divided shrinkage cavities, the general idea is to guide the solidification in such a manner as to produce a shell type of freezing as far as possible. This can be approached from the cooling side and from the alloying side. By intense cooling, one obtains a shell of fine equiaxed crystals growing rapidly from the mould wall into the liquid metal (see Fig. 9). If the cooling be less intense, a shell of columnar crystals will grow from the mould wall not quite so rapidly. With slow cooling, coarse, isolated crystals are formed in a layer of considerable thickness or even right through the whole mass of the liquid metal. This condition will also be reached eventually in thick cast sections when the solidified shell is thick enough to prevent rapid cooling of the interior by the mould walls. The shell type of solidification therefore requires intense cooling and the cooling must be the more intense the thicker the cross section of the casting.

The main connection between the alloy type and the distributed shrinkage is as follows: The more the alloy tends to maintain a layer of low melting liquid between the growing crystals right to the end of solidification, the greater is the danger of formation of long and narrow inter-crystalline passages which are likely to become blocked. The freezing of an alloy proceeds normally at first by one component in preference to the others; whilst this is going on a layer of low melting liquid surrounds each growing crystal. This layer

The Solidification of Metals

FIG. 13.—MICROSCOPIC INTERCRYSTALLINE SHRINKAGE IN THE RISER OF A MAGNESIUM ALLOY CASTING.
Top: X-ray radiograph of a slice. Bottom: Machined and polished. After G. Sachs, Prakt. Metallkunde.

becomes thinner and thinner as the crystals grow. Mostly this process comes to a stop before all is frozen. Then the original primary crystals stop growing thicker and between them the eutectic freezes very much like a pure metal.

If the proportion of metal frozen in such an alloy at various temperatures in the freezing range be calculated, the result is as indicated diagrammatically in Fig. 14. The assumption is made that the temperature gradient in the freezing zone is linear. Then the general shape of the crystals growing inwards from the mould will be as indicated in Fig. 14. In growing thicker at the mould wall the crystals will eventually be joined together by a layer of eutectic growing in the interstices, some distance behind the tips of the primary crystals. Before this happens there is, near the base of the dendrites, an arrangement of ramified channels filled with low-melting-point metal. The length (l) to which the liquid extends back from the tip of the dendrites increases with the width of the freezing interval of the alloy for a given temperature gradient. If there be little eutectic, as in Fig. 14 (a), say 5 per cent. by volume, these channels will be narrow and will tend to be blocked up sooner or later and a row of shrinkage "cells" each with a tiny angular or fissure like shrinkage hole will result.

If, however, the eutectic concentration be already reached after only half or two-thirds of the total has frozen Fig. 14(b), 30 per cent. eutectic by volume) it means that a coherent shell will be closed by the eutectic when the higher-melting-point primary crystals are still far apart and no tendency towards blockage of feeding channels will occur. It is in effect a slightly modified shell type of solidification.

What is needed, then, from the alloying point of view in order to avoid dispersed shrinkage, is an alloy composition either with no freezing range at all or with a considerable proportion of it freezing at a eutectic concentration and temperature; unfavourable are alloys with a large freezing interval and a small proportion of eutectic. It is know that typical casting alloys like cast iron and aluminium-silicon alloys contain a large amount of eutectic and that they are chosen for the ease with which they can be made into sound dense castings. On the other hand, alloys like steel or Y-alloy, essentially alloys having eutectic of the order of 1 to 10 per cent. only, whilst being very strong if the structure be good, are difficult to cast. Even the small amount of impurities in pure commercial aluminium is sufficient to produce trouble in castings due to the eutectic formed by a few tenths of one per cent. of silicon.

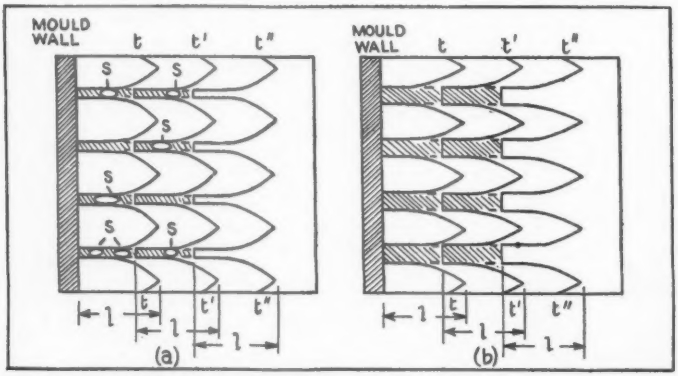

FIG. 14.—DIAGRAM SHOWING RELATION BETWEEN VOLUME RATIO OF EUTECTIC TO PRIMARY CRYSTALS AND DISTRIBUTION OF INTERCRYSTALLINE SHRINKAGE.

(a) Eutectic occupying about 5 per cent. of total volume. Arranged in narrow channels tending to be frequently blocked. (b) Eutectic occupying about 30 per cent. of total volume. Arranged in wide channels which do not tend to be blocked. The solid eutectic is shaded, $t - t$, $t' - t'$, $t'' - t''$ indicate the boundary between liquid and solid metal at three different moments during solidification. l is the length of intercrystalline channels filled with liquid eutectic; s the shrinkage cavities produced after blockage of intercrystalline channels.

Influence of Shrinkage Cavities on Mechanical Properties

A few words may be added on the influence of shrinkage cavities on the mechanical properties of castings. This consists of two effects, the reduction of cross-section and the notch or stress

(*Continued on p.* 280, *col.* 2)

London Conference Discussion

Aluminium Alloy Casting Developments*

By Dr. E. G. West, B.Sc., F.I.M.

Continuous Melting of Light Alloys

The CHAIRMAN (Mr. J. J. Sheehan) opened the discussion following the presentation of the Paper by Dr. E. G. West, B.Sc. He said he found difficulty in visualising the trend of the continuous melting equipment in aluminium furnaces. He understood that it was in serious competition with melting equipment of the cupola type in the iron industry, which was very economical and efficient.

DR. WEST said there were several possibilities for more continuous melting than existed at the present time, though it seemed impossible that the cupola would be used. The types of furnace used in aluminium foundries to-day were well known and established, but developments were bound to come. He considered that the greater use of low-frequency induction furnaces, which afforded a degree of continuity not given by other furnaces, as well as the greater tendency towards the use of reverberatory furnaces, would assist in reducing melting costs. These developments presupposed a reduction in the number of alloys in use in a particular foundry.

Recent Developments

MR. A. TIPPER strongly supported Dr. West's plea for more Papers on the developments that had taken place in production methods in aluminium foundries, particularly during the war period. Developments had taken place both in metallurgical practice and on the mechanical side of the light alloy foundry, and it was important that the results of research should be made known. To mention just one or two examples, the low-pressure method of producing die castings was very successful in promoting directional solidification, and it was capable of application to castings of varying size and design, and possibly to metals other than aluminium. Many difficulties had been overcome in the pressure die-casting process in designing equipment to withstand the high pressures used, and to take care of distortion and the effects of high temperature as well as pressure on the dies themselves. The principles and technique evolved could have other applications, and it would be useful if Papers concerning them were presented.

Mr. Tipper asked if Dr. West had had any problems put to him regarding sand castings, particularly in regard to the larger castings which were being made at the present time in light alloys, including those with large surface areas. He considered that sand control and the development of suitable sands was more necessary than ever before in the light alloy foundry, where problems concerning scabbing and surface cracking of mould surfaces were fairly common.

Emphasis might be laid on certain points raised by Dr. West, such as the use of insulating bushes and the possible adoption of semi-permanent moulds; also the application of feeding compounds and exothermic materials in feeding heads to reduce the amount of metal required to produce a sound casting.

Need for Practical Foundry Research

DR. WEST said that, with the exception of a few aluminium foundries, few details were known about the low-pressure process. Little had been published in this country and consequently he was obliged to go to a foreign source for the illustration in his Paper. He was not sure of the Patent position at present; nevertheless the process was undoubtedly applicable to other non-ferrous metals, though it might not be suitable for cast iron or steel.

Concerning the production of large sand castings, there were, of course, special problems involving sand control, the choice of sand, binders, and the like, and a certain amount of investigation was going on, partly by the founders specialising in this class of work. At the moment there was little full-scale research, but investigations into the reactions between the metal and the mould with different types of alloy, and the reasons for hot-tearing were in hand. The laboratory results would then require translating into production practice.

The general question was, of course, linked with Mr. Tipper's point on the intelligent use of insulated bushes and the application of special additions to control solidification. Freedom from scabbing and tearing was closely dependent on sand control and investigations of a fundamental nature must be followed by work in the individual foundries faced with specific problems.

Dr. West felt that, if efforts failed to persuade practical members of the Institute to put their knowledge and views into writing, the men responsible for laboratory research should present Papers written from the point of view of the practising founder.

Aluminium Bronze

MR. C. R. NORWOOD said that much aluminium bronze was being used at the present time; Stone's, of Deptford, whose works were visited during the conference, were using it in a large way for sand casting heavy propellers and also on a smaller scale for making gravity die-castings.

It was probable that 90 per cent. of the automobile gear selector forks used in England were made in

*Paper presented at the 1948 London Conference of the Institute of British Foundrymen, and printed in the JOURNAL, June 24 and July 1.

Aluminium Alloy Casting Developments

aluminium bronze by the gravity die-casting process. His own firm, Sagar Richards, specialised in this class of work and maintained a tensile strength of 37 tons per sq. in. and an elongation of 40 per cent.; these figures compared favourably with steel, and might, in fact, be said to be better, whilst the final cost of a ready-to-use aluminium bronze, die cast, gear selector fork, would be considerably lower than a similar article in steel. Extremely complicated shapes could be produced in this alloy by the die-casting process, and for this reason it was particularly suitable for gear selector forks. Dr. West was then asked to give his views on it.

DR. WEST regretted he could not give detailed information on aluminium bronze because, as it was a copper-base alloy, it was outside his normal range of interests.

Method for Gas Control

MR. D. F. B. TEDDS asked by what practical means gas content could be controlled. He had recently experienced two batches of DTD.133 material the behaviours of which on solidification were totally different, yet the alloys were practically identical in chemical composition. Could Dr. West say whether the peculiarities encountered were due to the gas content of the metal and, if so, what gases they were and how they could be controlled?

DR. WEST invited Mr. W. A. Baker to answer this question, in view of the considerable amount of work on this subject which had been carried out by the British Non-ferrous Metals Research Association.

MR. W. A. BAKER said the statement made by Mr. Tedds was not peculiar to aluminium; it applied to some other alloys. There was a great deal of truth in his comment.

In any complicated casting, with junctions of sections and changes of section, and so on, one tended to get a concentration of any shrinkage, and in such cases some gas in the metal was an advantage, because the porosity, when gas was present in that way, was more widely dispersed. In the case of a thin section running into a thick section, it was obvious that the former tried to freeze before the thicker one and tended to draw the metal from the adjacent heavier section, the latter acting as a feeder. A good deal depended upon the nature of the casting and in cases where it was chilled fairly rapidly, the effect was very marked. In a sand casting, where the rates of cooling were less rapid, the effect was less marked.

On the question of the control of gas content, Mr. Baker said it was not possible to give a very definite recommendation. A " reduced pressure " test was available, however, which could be used in a production foundry to get an approximate idea of the gas content of the metal just before pouring. This should be a useful aid in producing metal with a consistent and appropriate gas content.

The CHAIRMAN (Mr. J. J. Sheehan) said he was very conscious of the fact that the whole of the light alloy industry had been developed on the metallurgical side and undoubtedly there were a great number of foundry problems in connection with the casting of light alloys which had been solved successfully. Literature on those foundry problems did not appear to have been published, and he would be grateful for Dr. West's help in arranging for Papers of that character to be produced. The very nature of the light alloy industry indicated that its development would not have been possible but for a highly scientific training, but that training had tended to keep Papers on the subject to the metallurgical side. Papers of a practical flavour were urgently needed.

Threaded Bolt Holes

A MEMBER said that he had recently been asked for an alloy for sand casting with a thread which would stand the screw being inserted and withdrawn on several occasions without the thread tearing. His customer had come across one in America and Mr. Lester was curious to know whether such a casting alloy were available in England.

DR. WEST said that, although the choice of alloy was important, there were several other questions which affected the success or otherwise of aluminium alloy threads into which steel bolts would have to be screwed and unscrewed from time to time. If the alloy mentioned by Mr. Lester were obtained from America. there was little doubt that a comparable material was available in England. These other factors must, however, be taken into account and one of the most important was the accuracy with which the thread was cut. There was a tendency for aluminium threads to seize because of the softer nature of aluminium alloys compared with steel, and highly accurate thread cutting would help to avoid failures. The technique of cutting threads, and also the tool angles used, require modification to suit the particular class of alloy and there were available satisfactory recommendations for all machining operations of this kind. In general it was good practice to avoid the use of studs in aluminium whenever possible and frequently nuts and bolts could be used instead.

Death of Lord Greenwood

Lord Greenwood, who had been ill for several months, died at his home in London on Friday night. He was 78 years of age. A Canadian, Lord Greenwood had been prominently identified with the iron and steel industry for many years. He was president of the British Iron and Steel Federation in 1938-39, while he was associated with many firms in the industry. He was chairman of Dorman, Long & Company, Limited, Lewis Berger & Sons, Limited, Redpath, Brown & Company, Limited, and the Tees Side Bridge & Engineering Works, Limited, while he was deputy-chairman of the Darlington Rolling Mills Company, Limited. Lord Greenwood also served on the boards of the British Structural Steel Company, Limited, Pearson & Dorman, Long, Limited, and other companies.

He was Conservative M.P. for East Walthamstow from 1924 to 1929, and from 1933 to 1938 was honorary treasurer of the Conservative Party. He was a former Chief Secretary for Ireland.

Ironfounding Statistics*

The Meaning of the Period II Statistics to Ironfounders

The statistics for the second quarter of this year allow of some very interesting comparisons. At the present time, when much attention is being directed towards the ironfounding industry from the point of view of efficiency, it is very gratifying to record the fact that, with smaller supplies of basic raw materials in the shape of pig-iron and with only a very slight increase in the labour force, the output of the industry has risen over the previous period and constitutes another all-time record. In a recent speech to representatives of the textile industry, the Economic Secretary to the Treasury said that, because production in cotton and wool had risen faster than the labour force, this meant that efficiency and productivity had been rising. How much more so is this applicable to the ironfounding industry, when not only is it labour force steady but supplies of its basic raw materials have been reduced, and yet its output in tonnage is increasing!

It will be noticed from the figures in the second quarter that the output of grey iron castings—804,234 tons—shows an increase over the first of 3½ per cent., and the malleable output of 33,724 tons shows an equivalent increase of 9½ per cent., an overall increase on the previous quarter of 3.75 per cent. *The amount of production is at an annual rate of* 3.35 *million tons.*

The amount of pig iron charged in the second quarter was 576,741 tons, showing an increase over the first of 6,010 tons. The amount of scrap charged was 610,808 tons, showing an increase over Period I of 21,632 tons. For every 100 tons of good castings produced in Period II, the amount of pig-iron charged was 68.82 tons, as against 70.65 tons in Period I, and the amount of scrap charged was 72.90 tons, as against 72.95 tons, which shows an overall comparison in the metal melted of 141.72 tons in Period II, as against 143.6 tons in Period I. This is in itself a pointer to increased productivity. The receipts of bought pig-iron again fell in the quarter, and totalled only 450,034 tons, as against 455,807 tons in Period I, a decrease of 5,773 tons. This necessarily caused a fall in stocks at ironfoundries of 16,056 tons, amounting to 8.4 per cent. This now leaves a total stock equal to four weeks' stock based on the usage of pig-iron in Period II.

It is obvious that, to counteract this drop in pig-iron, ironfounders found it necessary to obtain larger supplies of scrap, and the figures themselves show that the C.F.A. scrap drive appeals have had satisfactory results. Scrap iron receipts rose from 255,119 tons in the first quarter to 273,726 tons in the second, showing an increase in bought receipts of nearly 19,000 tons and an increase in stock at the end of Period II of 8,655 tons.

Considering the decrease in pig-iron supplies and the situation that no foundry has closed for lack of pig-iron, it seems that a better distribution of pig-iron must be taking place in order to achieve these results. Although pig-iron is certainly still short, the all-round position of supplies is much easier than it was some weeks ago. It must, therefore, be acknowledged that modification of the licensing system, which has meant a more realistic approach to the problem of supply and demand, and which has been continually pressed for by the C.F.A., has had good results.

It is said that supplies of castings are easier now in certain sections of the industry, and this may very well be the case, but in others the demand is still as heavy as ever it was, and overall the position remains fairly constant. The orders on hand rose from 1,309,870 tons in the first quarter to 1,445,854 tons in the second, an increase of 135,984 tons. This in itself shows that the future still holds much promise for the output of iron castings, and that, although inroads have been made into the backlog of orders over the last year, there still remain many requirements to be met.

The increases in output in various sections of the industry are as follows: Pipes, 8 per cent.; textile machinery, 9 per cent.; agricultural, 2½ per cent.; machine tool, 4 per cent.; motor-cars, ½ per cent.; ingot moulds, 5 per cent.; iron and steel works plant, 6½ per cent.; rainwater pipes, etc., 3 per cent.; baths, 8 per cent.

Reductions in some sections were experienced, as follows: Domestic appliance castings, 14 per cent.; builders' ironmongery, 21 per cent.; cycle castings, 4 per cent.; sundry railway equipment, 7½ per cent.

To sum up, there is no doubt that to have accomplished an increased output at the present time it has been necessary to draw heavily on stocks of pig-iron. Nevertheless, as a result of the large receipts of scrap which must have been obtained as a result of the various scrap drives, the industry is getting back to something like the proportions of pig-iron and scrap melted in the early days of the war. If this trend can be maintained, and still more scrap obtained, and by improvisation of suitable methods the output can be held, there can be little doubt that the industry will overcome the difficulties which seemed likely to engulf it at one time as a result of the pig-iron shortage and the action of the Government in diverting foundry pig-iron facilities for "basic" steel production.

*Extracted from the General Bulletin of the Council of Ironfoundry Associations.

The Institute's Golf Competition

Entry forms for the Golf Competition organised by the Institute of British Foundrymen for October 15, will shortly be circulated to members. In the announcement in the August 19, issue of the JOURNAL regarding this competition, the holders of the honours were stated to be Mr. E. A. Phillips and Major J. Scott. This information related, however, to the 1938 event. The competition was last held in 1939, and the winners on that occasion were Mr. A. J. Stokes, the Handicap Challenge Cup, and Mr. D. Tinker, the Scratch Prize.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

ADDITION OF TOPAZ TO CAST IRON

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—The details of the recent work of the British Cast Iron Research Association on Nodular Cast Iron, published the other day, have drawn the attention of metallurgists all over the world to the inoculation of cast irons by materials containing cerium.

The author tried in India the inoculation of cast iron by substances in their natural form about five years ago. The experiment was carried out with a view to improving the chilled surface of cast-iron chilled rolls.

Topaz was added in the spout. This mineral is found at various places in the Singhbhum and Manbhum districts of Bihar, India. The sample used was dark brown in colour and contained niobate and tantalate of uranium, iron and the metals of the cerium group. On addition, the small dark brown stones were totally absorbed by the metal, only a little slag being formed. The mineral contains fluorites as well, and fluorine gas is evolved when it is added to the metal.

The metal to which it was added to the extent of 1 per cent. by weight had the following average analysis: T.C., 3.1; Si 0.5; Mn, 0.3; P, 0.3; and Su, 0.1 per cent. The metal was poured into cast-iron moulds. It was noticed that the chill consisted of primary carbides in a matrix of martensite, the grey part of the casting consisting of nodules of graphite and a matrix of pearlite where the cooling rate was very slow; some flake graphite surrounded by ferritic areas was also found. If the topaz was not added we did not find any of the abnormalities quoted above.

It was then thought that the unusual features were due to the action of nascent fluorine gas on the metal, even though we suspected that cerium and uranium might also be the causatory factors.

The use of such mineral as above has been patented.

Yours, etc.,

Jemco Limited, DR. H. TRIVEDI.
Tatanagar, B.N.R., India.

Foundry Education in Bedford

In co-operation with iron and brass foundries in Bedford, the local Education Authority is arranging to hold pre-apprenticeship courses in foundry work at the North Bedfordshire College of Further Education. Boys will, on leaving school, be able to divide the first three months of their time at the college between class work and practical foundry work, and they will be asked to choose a local firm which will take them as employees from the time they commence the course. The firms will pay the trainees at standard rate for their age while they are at college, and at the end of the 12 weeks they will enter the foundry as probationary apprentices. If their progress be satisfactory they will, after a further three months, become indentured apprentices.

The Solidification of Metals

(*Continued from page* 276)

concentration effect which can be even greater than the mere reduction of cross section. Round bubbles have a smaller effect in both respects." They can be unexpectedly dangerous if they are formed in narrow gaps between crystals, that is, arranged in layers across the direction of stress. Inter-dendritic shrinkage is expected to cause a higher degree of weakening for the same volume compared with spherical cavities; first, because the cross section is reduced more than their volume indicates, and second because their sharp edges produce marked notch effects.

Recently a series of measurements regarding this point have been published,[10] and whilst they may not be very consistent they can be considered as generally confirming the conclusions described. In a casting where porosity was mainly in the form of round bubbles, the relative drop in tensile strength was about five times as much as the proportion of cavities present, whilst in a casting with mainly interdendritic cavities the tensile strength was reduced 10.5 times as much as the amount of cavities indicated. In a casting with typical intercrystalline cavities the tensile strength was affected 12.5 times as much and the elongation 23 times as much as the volume of interdendritic cavities indicated.

Conclusion

This short review of the main features of the solidification of metals and their connection with the shrinkage problem is certainly not a recipe for the production of good castings, but it can be a guide for making intelligent observations during work in the foundry and thus lead to improvements or shorten the road to success in difficult cases.

Apart from this, the process of solidification has, to the Author, always been a fascinating subject, and he will consider it as a success if this lecture creates similar interest in this subject in others.

The Author is indebted to Mr. J. Wood for helpful criticism and assistance, and to Mr. M. Avis and Mr. H. Harris for help in preparing tables and illustrations. The Author thanks the Directors of International Alloys, Limited, for permission to publish.

6 E. W. Fell. *J. Inst. Metals*, 1947, 73. 243.
7 H. F. Taylor, E. A. Rominski. American Foundrymen's Assoc. Preprint No. 42–20. Annual Convention, Cleveland, 1942.
8 T. E. Lloyd. *Iron Age* (1946) April 25th, p. 62–64.
9 M. W. Dougherty and L. W. Kempf. *American Foundryman*, 1945, Nov.
10 W. T. Pell-Walpole. *Metal Industry*, 1946, 68. p. 303-305. 323-324, p. 346-348.

Pageant of Production

The civic, industrial and trade union authorities of Sheffield are combining to stage a pageant of production from November 15 to 27. The actual pageant will be staged in the City Hall, and this will be supplemented by an exhibition, in the Cutler's Hall, of the craft of the silver-smith. L. Du Garde Peach is writing the script for the pageant.

Personal

SIR ROBERT SINCLAIR has been appointed deputy president of the Federation of British Industries.

MR. C. S. COLBECK, works manager, has been appointed a director of British Jeffrey-Diamond, Limited, Wakefield.

AIR-MARSHAL SIR RALPH S. SORLEY is to join the board of De Havilland Propellers, Limited, Hatfield, Herts, as chief executive, at the end of this year.

MR. BENJAMIN BOTT, of C. & W. Walker, Limited, gasworks engineers, of Donnington, Salop, retired on August 27 after 66 years' service with the company.

MR. WILLIS ROXBURGH, a director of Albion Light Metal Products, Limited, Dundee, has been adopted as Conservative candidate in a by-election in the Gorbals Division of Glasgow.

COL. E. G. ANGUS, chairman and managing director of George Angus & Company, Limited, power-transmission engineers, of Newcastle-upon-Tyne, has been elected vice-chairman of the Engineering Industries Association.

MR. F. S. HOOPER and MR. C. B. COWLEY have resigned from the board of Henry Meadows, Limited, petrol- and Diesel-engine manufacturers, of Wolverhampton. MR. R. S. CRUMP, chief engineer, has been appointed technical director.

MR. S. MCCOUBREY, who is chairman of the Belfast district committee of the Confederation of Shipbuilding and Engineering Unions of the United Kingdom and local secretary of the National Union of Sheet Metal Workers, has been appointed a member of the new Ulster Transport Authority.

DR. A. B. EVEREST will be spending a fortnight in Switzerland during October, in order to visit many of the larger engineering firms to discuss technical developments of special nickel alloys. In particular, he will be reviewing the latest developments in high-duty alloy cast iron as applied to power-plant and general engineering applications.

Wills

WEST, G. P., formerly a director of Colvilles, Limited	£41,208
RIMMER, E. S., chief draughtsman of the Lancashire Steel Corporation, Limited	£2,718
SMITH, SYDNEY, managing director of the Wellman Smith Owen Engineering Corporation, Limited ...	£11,989
MAWDSLEY-HARTE, HERBERT, formerly of Smith's Dock Company, Limited, North Shields, and other companies	£70,494
CORBETT, G. T., founder and chairman of the C. & S. Construction Company, Limited, Isleworth, Middx	£19,243
VAUGHAN, F. H., chairman and managing director of Vaughan Bros. (Drop Forgings), Limited, Willenhall	£200,201
MICKLETHWAITE, W. H., of W. H. Micklethwaite & Company, Limited, ironfounders, etc., of Rotherham	£115,274
BOOTH, FREDERICK, foreman of the pipe shop and fettling department of the Staveley Coal & Iron Company, Limited	£2,525
MACLEOD, J. T., founder and for many years chairman and managing director of J. Thomson MacLeod, Limited, tool merchants and agents, of Glasgow, and the North British Lifting & Moving Appliance Company, Limited, Glasgow ...	£65,053

Clyde Unemployment Report Repudiated

The possibility of unemployment in the Clyde shipbuilding industry has been repudiated by Mr. Robert Harkness, chairman of the Clyde branch of the Confederation of Shipbuilding and Engineering Unions of the United Kingdom, who points out that some firms are employing men on regular overtime on two or three nights a week and are complaining that men are not available on Saturdays. This, he states, shows that in some establishments it is impossible to finish the normal work in ordinary time.

Mr. Charles Murdoch, chairman of the Scottish Board for Industry, has also declared that if there is any unemployment it is not being caused by a shortage of steel but by a shortage of components, most of which are made by sub-contractors. More tankers are being constructed on the Clyde than at any previous time, but the output of passenger and cargo tonnage may be showing a downward tendency owing to the reluctance of large shipping firms to place orders except at fixed prices and delivery dates.

Head, Wrightson's Record Turnover

"This last year the turnover and the gross trading profits of our group of companies have established a record in the history of the company, but due recognition must be given to the decreased purchasing power of the £," writes Sir T. G. Wrightson, chairman of Head, Wrightson & Company, Limited, engineers and foundrymen, of Thornaby-on-Tees and Stockton-on-Tees, in a statement circulated with the accounts for the year ended April 30 last. "Compared with the volume of business we transact, the amounts distributed are very small, as the following figures show:—For every £1 of finished equipment sold we apply: 10s. 6d. to materials; 5s. 4d. to wages and salaries; 1s. 3d. to overheads; 1s. to taxation and social service; 8d. to electricity and fuel; 8d. to depreciation and reserves; 4½d. to freight, and 2½d. to dividends."

The chairman states that the company's new development in aluminium structures continues to make progress. The first light-alloy bascule bridge in the world is due shortly to be erected. Separate shops are now allocated to this form of construction.

Power Cuts for Commerce

Domestic consumers will continue to make voluntary reductions, but commercial undertakings in London and the South-East will have to submit to compulsory cuts in their consumption of electricity during the winter to avoid load-shedding. Failure to do so will make them liable to legal proceedings. This was announced at a Press conference on September 6. Last winter industry was subject to a 33⅓ per cent. reduction during the hours of peak load, but the contribution of commerce was voluntary.

News in Brief

CALEDON SHIPBUILDING & ENGINEERING COMPANY, LIMITED, Dundee, has received an order for a 10,000-ton cargo liner for Dutch owners.

AN INVITATION to attend the opening performance of the Sheffield Pageant of Production on November 15 has been accepted by Princess Margaret.

R. H. NEAL & COMPANY, LIMITED, Grantham, has secured a six-figure order for 60 mobile cranes from the Polish Purchasing Commission. This is the largest single order in the company's history.

SPARKS FROM a railway engine may have been the cause of a recent outbreak of fire in a store at Durie Foundry, Leven, when large stocks of varnished wood patterns for machine parts were destroyed.

HENRY SIMON, LIMITED, Stockport, Ches, has secured a contract from the Argentine Government for the complete electrical and mechanical equipment of a 150,000-ton grain-storage and shipping elevator, the largest in the Southern hemisphere.

GRANGEMOUTH DOCKYARD COMPANY, LIMITED, has received an order from George Gibson & Company, Limited, Leith, for a single-screw motor coaster. The propelling machinery will be supplied by British Polar Engines, Limited, Glasgow.

A NORWEGIAN FIRM of shipowners has cancelled a shipbuilding contract placed with John Crown & Sons, Limited, Sunderland, two months ago. The order has been transferred to a German shipyard at Kiel which had promised speedier delivery.

STATED TO BE the first of its kind in the world, a 110-ft. aluminium lifting bridge has been built by Head, Wrightson & Company, Limited, Thornaby-on-Tees, for the River Wear Commissioners. The bridge is to span the entrance of a dock at Sunderland.

NO-ONE WAS INJURED when the bottom of a blast furnace collapsed at the Acklam Works of Dorman, Long & Company, Limited, Middlesbrough, last week, but the hold-up in supplies of iron may affect employment in the steel mills and sheet works temporarily.

GEORGE CLARK (1938), LIMITED, Sunderland, has under construction four Diesel engines, each of 1,200 b.h.p., the first Diesels of this comparatively low power to be built on the North-East Coast. The four engines are for British-owned colliers on order at Sunderland.

IN A RECENT ISSUE we published a note indicating that Rapax, Limited, Sheffield, was now making "Deoxidine" and "Deoxylite." We are informed, however, that Imperial Chemical Industries, Limited, Paints Division, are the sole concessionnaires for these two products.

FOLLOWING A MEETING at Leicester between the Confederation of Engineering and Shipbuilding Unions of the United Kingdom and the employers' association, it has been announced that the engineering industry in the Leicester district will introduce staggering by working (*a*) and (*b*) shifts.

BRUSH ELECTRICAL ENGINEERING COMPANY, LIMITED, Loughborough, J. & H. Mclaren, Limited, Leeds, and Mirrlees, Bickerton & Day, Limited, Stockport, have secured further contracts from the trade delegation of the U.S.S.R. for the supply of Diesel engines and electrical equipment to Russia amounting to £3½ million.

SPEAKING AT THE launch of the tanker British Liberty, built by William Doxford & Sons, Limited, Sunderland, Mr. J. Ramsay Gabbie, managing director of the company, stated that if prices continued to rise, he could visualise the time when shipyards would be pleading with shipowners to place even single orders to keep the yards going.

AN IMPROVEMENT in steel supplies for textile machinery was reported at a recent meeting in Manchester of the North-Western Regional Board for Industry. The chairman (Major J. H. Mandelberg) said that steps had been taken by the British Iron and Steel Federation to ensure that textile accessories' manufacturers would receive adequate supplies.

THE EDINBURGH DISTRICT ADVISORY COMMITTEE of the Scottish Board for Industry has decided to draw the attention of the appropriate authorities to the lack of scrap for use in ironfoundries. It was stated at a recent meeting that available scrap was earmarked for steelworks and that ironfoundries were "left out in the cold."

THE MAIN CONTRACT for the North of Scotland Hydro-Electric Board's project at Glen Shira, Argyllshire, has been awarded to A. M. Carmichael, Limited, public works contractors, of Edinburgh. Babtie, Shaw & Morton, Glasgow, are the civil engineering consultants, and the generating plant will be made by Harland & Wolff, Limited, for the English Electric Company.

MR. W. H. MORGAN AND MR. W. S. EVANS, joint owners of the Pontardawe Coal & Metal Company and the Pontardawe Foundry & Engineering Company, Glam, have established a light engineering and sheet-metal plant at Newcastle, Natal, South Africa. The factory was erected and production begun in six weeks. Substantial orders have already been obtained to supply engineering equipment for use in the ground-nuts scheme.

THE MINISTRY OF TRANSPORT has decided to curtail and eventually stop the repairing and reconditioning of British railway locomotives at the Scotswood Works, Newcastle-upon-Tyne, of Vickers-Armstrongs, Limited. Concern has been expressed by the men employed there and, following representations, work will be stopped in March, 1949, instead of at the end of this year as originally intended. The reason for the stoppage is stated to be that there are now fewer engines needing repair and reconditioning than there were after the war ended.

"Wolseley 14 h.p. Engine."

A NUFFIELD PRODUCT

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STANTON-DALE

REFINED PIG IRON

USED AND RECOMMENDED
FOR ALL HIGH-DUTY
ENGINEERING CASTINGS

THE STANTON IRONWORKS COMPANY LIMITED, Nr. NOTTINGHAM

Company News

(Figures for previous year in brackets.)

Glover & Main—Interim dividend of 5% (same).

British Lead Mills—Interim dividend of 12½% (same).

Walsall Conduits—Interim dividend of 20% (same).

Engineering Components—Interim dividend of 10% (same).

Craven Bros. (Manchester)—Interim dividend of 5% (same).

Clayton Dewandre Company—Interim dividend of 4% (same).

Lancashire Dynamo & Crypto—Interim dividend of 5% (same).

Cammell Laird & Company—Interim dividend of 5% (same).

Newton Chambers & Company—Interim dividend of 5% (same).

W. H. Dean & Son—Final dividend of 40%, making 50% (same).

Willenhall Motor Radiators Company—Interim dividend of 15% (nil).

Brown Bros.—Interim 5% (compares with 2½%; to achieve a better balance between the interim and the final dividends).

Mansfields—Consolidated net trading profit to March 31, £38,358 (£42,405); dividend of 15% (same); forward, £7,912 (£6,756).

Dobson & Barlow (Securities)—Profit to June 30, including £188 reserve no longer required, £9,632 (£8,591); dividend of 10⅞% (same); forward, £7,032 (£5,658).

Fletcher Hardware Company—Trading profit for 1947, £43,112 (£36,614); income from investments, £887; taxation, £23,725; net profit, £18,874; to general reserve, £10,000 (nil); dividend of 15% on the ordinary shares; forward, £7,935 (£6,177).

Aveling-Barford—Interim dividend of 5%, less tax, for the year ending September 27. (For the previous period of 18 months there was a first interim dividend of 5%, tax free, a second interim dividend of 4%, less tax, and a final dividend of 10%, less tax.)

Cementation—Profit to March 31, £81,274 (£75,170); dividends from subsidiaries, £20,400 (£65,086); to taxation, £12,496 (£57,936); interest on bank overdraft, £9,326 (£5,726); preference dividends, £16,626 (£10,725); ordinary dividend of 25% (same); to general reserve, £15,780 (£20,000); taxation reserve, £27,790 (nil); forward, £26,455 (£38,947).

Geevor Tin Mines—Profit to March 31, after mine expenditure, depreciation, etc., £16,470 (£10,500); mine development suspense, £36,561; dividend of 10% (same); to taxation, £8,820 (£4,500); written off mine development balance at March 31, 1947, £15,100 (nil); shaft sinking and permanent development, £2,000 (£1,000); to mine development reserve, £21,461 (nil); forward, £7,757 (£7,783)

London Tin Corporation—Dividends from investments and interest in the year ended April 30, £255,179 (£124,503); sundry net profits on realisations, £4,042 (£55,159); to directors' emoluments, £2,700 (£2,586); administration and other expenses, £21,135 (£36,970); tax from dividends, less amount recovered, £69,797 (£22,822); net profit, £165,589 (£117,284); to dividend of 6% (4½%), £119,402 (£89,551); forward, £236,573 (£190,386).

Berry's Electric—Profit for the year to March 31, £65,947 (£89,900); interest, £2,119 (£2,220); to depreciation, £4,550 (£4,569); replacement of tools, £1,064 (£1,818); directors' emoluments, £6,791 (£5,866); staff pensions, etc., £1,535 (£1,024); written off properties, £1,512 (£1,513); 7½% notes interest, £2,025 (£2,141); loss on investment sale, £343 (nil); dividend of 12½% (same); deferred repairs, £2,000 (£7,500); tax, £29,361 (£35,545); general reserve, £10,000 (£22,500); forward, £8,914 (£9,724).

Head, Wrightson & Company—Group trading profit for the year ended April 30, after charging directors' emoluments, £323,109 (£206,186); other income, £519 (£457); to tax, £134,800 (£84,681); depreciation, £69,068 (£49,509); debenture and loan interest, £7,967 (£7,991); audit fee, £993 (£1,060); preliminary expenses, nil (£864); redemption of loans, £625 (same); undistributed profits of subsidiaries, £34,270 (£490); parent company's net profit, £75,905 (£61,432); dividend of 10% (same); reserve, £20,000 (£10,000); reserve for pensions, £15,000 (£5,000); dividend accrued on 4½% preference shares, £528 (nil); forward, £81,972 (£73,163).

George Cohen, Sons & Company—Consolidated trading profit to March 31, £1,036,518 (£695,888); dividends from associated companies, etc., £19,450 (£18,424); to interest on overdraft, £5,121 (£37,959); emoluments, £35,000 (£24,506); audit, £3,373 (£3,568); depreciation, £89,859 (£71,996); profits tax, £127,911 (£46,966); income tax, £375,526 (£285,093); to minority holders, £6,203 (£5,585); profits of subsidiaries applicable to George Cohen, £61,985 (£12,747); net profit of parent company, £350,990 (£225,892); to pensions, £17,073 (£23,679); new issue expenses, nil (£55,298); to general reserve, £210,000 (£65,000); preference dividend, £24,904 (£21,531); final ordinary dividend of 12%, making 20%, £66,000 (£53,900); forward, £73,423 (£40,410).

THE DIRECTORS of the Associated Equipment Company, Limited, manufacturers of motor vehicles, of Southall, Middx, propose that the company's functions shall be limited to those of a holding company. The business and manufacturing assets would be transferred to a wholly-owned subsidiary in consideration of fully-paid shares in that company. It is also proposed to change the name to Associated Commercial Vehicles, Limited.

Hard and Fast Hitters

The "X" range of **HOLMAN RIVETING HAMMERS** is well known for speed, power and general handiness. The newer and heavier "ER" Hammers are rapidly building a similar name because of their outstanding performance. All models embody the Holman combination of a main valve plus auxiliary valve. This feature not only improves the over-all efficiency of the hammers but it also reduces recoil to a very low order. The throttle enables the operator to regulate the force of the blows to the exact weight required. Outside or inside trigger handles can be supplied as required.

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WW EP 34

Raw Material Markets

Iron and Steel

Steel output last month reached an annual rate of 14,117,000 tons. This is the highest rate of output recorded for August, and was achieved despite the incidence of holidays in the early part of the month. Pig-iron production was at an annual rate of 9,048,000 tons in August, compared with 8,908,000 tons in July and 7,657,000 tons in August of last year.

Complaints of a shortage of pig-iron are now confined to the light-castings industry. Production of basic iron is fully abreast of steelworks' needs, and if the engineering and speciality foundries cannot always procure the particular grade of iron they require, another class of iron is usually available and can be incorporated in cupola mixtures. But for the production of light castings, high-phosphorus iron is essential, and not enough is being produced. This has now become a matter of urgency, and if the coke position does not permit of an overall increase in the number of blast furnaces operating, it is suggested that the Control might consider the changing of one or two furnaces from basic to foundry-iron production. Certainly some such solution must be found if the manufacture of light castings is to be brought within measurable distance of the demand.

Prospects for the re-rolling industry are perceptibly brighter. Many of the mills have been working well below capacity simply because of the lack of material. They have an abundance of orders for light sections, small bars and sheets, but for months past have been short of small billets and sheet bars. No dramatic transformation in the supply position is anticipated, but deliveries from home sources—which constitute the bulk of the supply—are improving, and bigger tonnages will shortly be coming to hand from Belgium and Luxemburg. All this material can be put to immediate use, and it is notable that in the meantime works are as keen as ever to acquire defective billets, sheet bars and crops

The heavy steel mills are all engaged to the limit of their capacity. They have still substantial tonnages to deliver before the end of the month and bookings for Period IV are already extensive. Plates are in very active demand for export and, in a slightly expanding volume of shipments to overseas destinations, wrought-iron tubes and railway material figure conspicuously. Most urgent of all is the home and export demand for light sheets. With overseas buyers price seems to be no object, but the tonnages released for export are strictly limited. Wire products and reinforcement bars are also keenly sought, while the collieries continue to take up their full quotas of maintenance material.

Non-ferrous Metals

Those who have been watching the upward movement during the past few years of copper production in Northern Rhodesia will not be surprised that the mines are again in difficulty due to shortage of coal. This happened last year and quite a large tonnage was lost in consequence. How long the present interruption will last it is difficult to say, but apparently certain mines have been obliged to suspend operations, while activity at both the smelter and the electrolytic refinery is much reduced. This cut in Rhodesian output is particularly unfortunate at the present time, but, fortunately, the Ministry of Supply has found it possible to continue with supplies of dollar copper, both blister and refined. Stocks of copper, too, in the United Kingdom are relatively high, the total at the end of July being in the neighbourhood of 100,000 tons, including the tonnage held by consumers as well as by the Government. This comprises only raw material, *i.e.*, cathodes, wire-bars, cakes, etc., the only exception being a tonnage of rolled rod. Thus, we are fairly well stocked so far as copper is concerned and, indeed, are actually far better placed than in lead and zinc. Zinc stocks show some improvement, but the lead position at the end of July was quite serious.

Figures have been published relating to the United States Government's stockpiling plans and, for the most part, comments are to the effect that the tonnage is a good deal lower than might have been expected. The U.S. Munitions Board has a programme of purchases for the last quarter of this year which will be earmarked for delivery up to June 30, 1949. Copper is marked as 30,000 short tons, zinc and lead 16,000 tons each, and nickel 7,500 tons. Tin is to be bought up to 4,500 long tons. These amounts are not likely to interfere with the requirements of industry, and it would be interesting to know whether there has been any change of plan in regard to stockpiling, *i.e.*, have the American authorities decided that they can afford to cut down on their programme? The price structure in America is quite firm, but grain, which has eased of late, will presumably move lower still in the face of the bumper harvest anticipated in the United States, and this downward trend may well have some effect on the quotations of other commodities, not excepting metals.

Engineering Unions to Meet Employers

Meeting at Margate, on September 6, the Engineering Group Council of the Confederation of Shipbuilding and Engineering Unions considered the recommendations of the Government court of inquiry into the claim for increased wages in the engineering industry. Mr. Gavin Martin, secretary of the Confederation, said after the meeting that it had been decided to try to arrange a meeting with the engineering employers as soon as possible and to arrange a similar meeting with the shipbuilding employers, with whom a separate wage claim has been lodged which has yet to be the subject of a court of inquiry.

It was announced later that a joint meeting between representatives of the National Engineering and Allied Employers' Federation and of the Confederation will be held in London on September 21.